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Report of the Section on Sanitary Science.

PRACTICAL MEASURES FOR THE RESTRICTION OF CONTAGIOUS AND INFECTIOUS DISEASES.

By George H. Rohé, M. D., *Chairman.*

I desire to invite your attention to some practical measures for the restriction of contagious and infectious diseases.

During the five years ending December 31, 1887, the total number of deaths in Baltimore was 42,637. Of these, 18,629, or 43.2 per cent, were due to contagious or infectious diseases, if pneumonia, consumption, diarrhœa, and dysentery are included in this class. In my opinion, recent researches entirely justify us in classifying the diseases mentioned as infectious.

Assuming that the average death-rate of all infectious diseases is one in five of those attacked, or 20 per cent—which is a very high estimate—this would give us nearly 100,000 cases of infectious diseases during the period mentioned.

Sanitarians consider infectious diseases as preventible. If this is a fact, a large proportion of the population of this city (5 per cent) is annually attacked by preventible disease which kills one out of every five attacked. Is there justification for such a record?

In the following pages I shall attempt to show by the plainest kind of evidence that the exercise of public and private forethought will not merely reduce the sickness and death-rate from infectious diseases, but in some instances will prevent them altogether.

From a sanitary point of view, we have to consider two classes of pestilential diseases, *i. e.* the exotic, or imported, and the domestic, some or all of which are also transportable. The exotic pestilences against the importation of which we must protect ourselves are yellow fever, cholera, typhus fever, and relapsing fever. The domestic pestilential diseases are diphtheria, scarlet fever, small-pox, measles, whooping cough, typhoid fever, pneumonia, consumption, dysentery and other diarrhœal diseases.

The main principles of the preventive treatment of these two classes of infectious diseases are identical; they comprise these three measures: *Notification, Isolation, Disinfection.* What is meant by these terms? Are they merely shibboleths or watchwords, or do they represent things to be done, and methods of doing them?

By *notification* is meant the giving of accurate information to the proper sanitary authorities of the existence of cases of contagious and infectious disease, and their location. It should be made compulsory by law, and any violation or evasion of the law should be severely punished. The question whether the notification should be made by the physician, or by the householder, or person under whose charge the patient may be at the time of the sickness, is one that has been much discussed. To me there seems only one rational conclusion, and that is that the physician in attendance upon the case, or who becomes cognizant of it in a professional capacity, shall give the information. He is the only person competent to give an authoritative opinion on the nature of the case. He can more readily make himself familiar with the proper forms to be observed in making the reports. It simplifies the mechanism of the notification and the subsequent measures to be taken, in that it substitutes a direct communication with the proper authorities for a roundabout channel through a second or third person—for the first notification of the character of the disease must come from the physician any way. It therefore seems just that the physician shall inform the authorities, as well as the patient or his protectors.

It is claimed by some physicians that to give publicity to the character of their patients' disease would be a violation of professional confidence, and hence unethical. This seems to me an exceedingly absurd claim. A distinguished sanitarian says upon this point, "It is a parody on ethics to class as professional family secrets the concealment from a health officer that there is small-pox in Mr. A's family, or that Mr. B's children are having the scarlet fever or diphtheria."

But there is another objection made by many physicians which seems to me to have more validity. It is held that while the State may have power to render the notification of infectious diseases compulsory on the part of physicians, this service cannot be exacted gratuitously. In a paper published in the seventh report of the Maryland State Board of Health I have expressed my views in these words: "This duty [notification] should not be asked of the

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physician without offering him compensation for his time and labor. No lawyer will issue a legal document of any kind without exacting payment, either from the individual or from the State. In cases where the State is benefited, it should pay for the benefits received. Notification of infectious diseases is for the protection of the State, and the protected party should pay for the service. It is absurd and unjust to expect physicians to give their time and service to the general public gratuitously, especially as all other classes of citizens exact compensation for every similar service."

It is not claimed that the compensation for this service should be an equivalent for the work performed, but merely an acknowledgment of the principle that the public has no right to demand special services from one class of citizens without paying for the same.

There is at present an ordinance of the city of Baltimore which requires physicians to report all cases of infectious disease occurring in their practice, but it is notorious that its breach is more common than its observance. Until the law is enforced upon all who are allowed to practice, no tangible results can be expected from it.

Notification of infectious diseases should not be merely municipal, but inter-municipal and inter-State. Nay, the spread of the appreciation of preventive medicine leads to the hope that we may soon have international notification—a consummation not only earnestly desired by all progressive sanitarians, but confidently looked forward to by many.

The necessity of inter-state notification is particularly obvious in this country where commerce and travel by rail practically obliterate State lines and boundaries. In order that no serious interruption may occur to inter-state traffic in a time of threatened epidemic disease in any part of the country, State health organizations should promptly notify all kindred bodies of any outbreak. This subject was fully discussed by the conference of State Boards of Health at the meeting held in Toronto, Canada, in October, 1886, and all the State health organizations represented pledged themselves to promptly report to each other the outbreak of cholera, yellow fever, or small-pox.* It is to be regretted that some of the organizations fail to faithfully carry out this compact.

* The following are the resolutions referred to:

WHEREAS, It is necessary for the protection and preservation of the public health that prompt information should be given of the existence of cholera, yellow fever, or small-pox; be it

The question may be asked, and it is an eminently proper one, whether notification of infectious diseases to the sanitary authorities, when combined with the prompt enforcement of proper sanitary

Resolved, That it is the sense of the National Conference of State Boards of Health, that it is the duty of each State and Provincial Board of Health within whose jurisdiction any of said diseases may occur, to furnish immediate information of the existence of such disease to Boards of Health of neighboring States and Provinces, and to local boards in such States as have no central board, in which the duty of notification shall lie upon the local boards.

2. That upon the prevalence of rumor of the existence of pestilential disease in any State or Province, if positive, definite information thereon be not obtainable from the proper health authorities, this Conference holds that the health officials of another State are justified in entering the before-mentioned State or Province for the purpose of investigating and establishing the truth or falsity of such reports.

3. That whenever practicable, the investigations undertaken under the preceding section shall be made with the co-operation of the State or local health authorities.

4. That any case which presents symptoms leading to serious suspicion of the existence of one of the aforenamed diseases, shall be treated as suspicious, and reported as provided for in cases in which the diagnosis is certain.

5. That any case respecting which reputable and experienced physicians disagree as to whether the disease is or is not pestilential, shall be reported as suspicious.

6. That any suspected case respecting which efforts are made to conceal its existence, full history and true nature, shall be deemed suspicious and so reported.

7. That in accordance with the provisions of the foregoing resolutions, the Boards of Health of the United States and Canada represented at this conference, do pledge themselves to an interchange of information as herein provided.

The following resolutions, explanatory of the above, were adopted by the National Conference of State Boards of Health, at Washington, September 8, 1887:

1. *Resolved*, That the conference re-affirms the principles contained in the resolutions adopted by it at its meeting in Toronto, in 1886.

2. That the communicable diseases hereinafter mentioned, prevalent in certain areas, or which tend to spread along certain lines of travel, be reported to all State and Provincial Boards within said area or along said lines of communication.

3. That in the instance of small-pox, cholera, yellow fever, and typhoid fever, reports be at once forwarded, either by mail or telegraph, as the urgency of the case may demand; and further, that in the instance of diphtheria, scarlatina, typhoid fever, anthrax or glanders, weekly reports, when possible, be supplied, in which shall be indicated, as far as known, the places implicated and the degree of prevalence.

measures by the latter, has resulted in any improvement in the sickness and death-rate. The answer can be given in cold figures which apparently tell a straightforward story.

In the London *Practitioner*, Vols. 34 and 35, a review is given of the results of the notification of infectious diseases in a number of English towns and cities. From this series of articles I quote the following summary:

"At Bolton the average general mortality had fallen from 25.9 to 21.1 per thousand, and the percentage from 'the seven principal zymotic diseases' to total deaths from 20.2 to 17.0. . . . . At Huddersfield, comparison between three years before the passage of their first act and three years subsequent to the passage of their amended act shows the following in rates per thousand: As regards the general death-rate, a diminution from 22.7 to 21.5; as regards smallpox, a diminution from 0.07 to 0.00; as regards scarlet fever, a diminution from 0.94 to 0.18; as regards diphtheria, from 0.12 to 0.05; and as regards 'fever,' from 0.35 to 0.16. . . . . At Oldham the general mortality had slightly fallen, namely, from a rate of 23.9 to 23.0, and 'zymotic diseases' from 4.0 to 2.2 per thousand. At Reading the general rate of mortality had fallen from 18.4 to 16.8, and the rate from 'zymotic diseases' had shown a trivial decrease from 2.8 to 2.5 per thousand. At Salford, again, the general death-rate had fallen from 23.3 to 22.0, and the 'zymotic' rate, which stood as high as 3.8, became 3.6." These statistics show in general, although not to a very marked degree, the beneficial influence of the prompt notification of infectious diseases, and a careful reading of the individual reports indicates that the greater benefit is obtained in those places where the sanitary authorities have power to enforce isolation and disinfection.

In the same journal for October, 1886, is a table and quotations from the annual report of Dr. B. A. Whitelegge, the Medical Officer of Health of Nottingham, a city of about 200,000 inhabitants. The table shows a marked reduction in the cases of every infectious disease reported, except measles and whooping cough. Obviously these two affections, being generally regarded as trifling ailments, are comparatively seldom brought to the notice of the physician, and consequently not reported and no measures taken for their restriction. Dr. Whitelegge makes the following comments on the table:

"1. The decline in each case commences with the commencement of compulsory notification. The consideration suggested above with

regard to small-pox and scarlet fever, viz. that they may have been taken at the crest of an epidemic wave, does not hold good in the case of enteric fever, which had been slowly gaining ground for several years previously, without any special epidemic.

"2. The decline is continuous. In scarlet fever we have an uninterrupted fall for four years, the notifications meanwhile becoming more and more numerous in proportion to the deaths; that is, the system has gradually come into full operation.

"3. The decline in the scarlet fever mortality is greater than can be accounted for by the general diminution throughout the country. The death-rate from scarlet fever in 1885 was in Nottingham 0.13 per 1000, and in twenty-eight [other] large towns 0.24.

"5. The decline which has been so curiously constant in the notified diseases has not taken place in the other zymotic diseases. Whooping-cough has largely increased in mortality, and measles has held its ground.

"The conditions discovered and dealt with in consequence of notification are such as would almost inevitably, in the absence of interference by the sanitary authority, have led to spread of infection. In cases of scarlet fever it is the exception, and not the rule, for children to be voluntarily kept away from school until the infective stage is over—that is, until desquamation has entirely ceased. Medical supervision does not, as a rule, extend beyond the earlier or acute stages of illness, and the friends have little regard for the protracted but still infectious stage of convalescence which follows. Isolation within the household is frequently little more than a name, and after the first fortnight or three weeks is rarely attempted. Nevertheless it is often found that children from infected houses are going to school up to the date of the first visit of inspection, and the parents are only too ready to send them again without waiting for the recovery of the case and proper disinfection of the premises. But for notification, the vast majority of such cases would remain undiscovered. As it is, few escape detection, and by the co-operation of the School Board authorities we are now enabled to prevent the schools from becoming channels of infection on a large scale." It will be a powerful aid to the advance of preventive medicine when the School Board of this city obtains the authority to take like measures in conjunction with the Health Department to limit the capacity of the schools as "channels of infection."

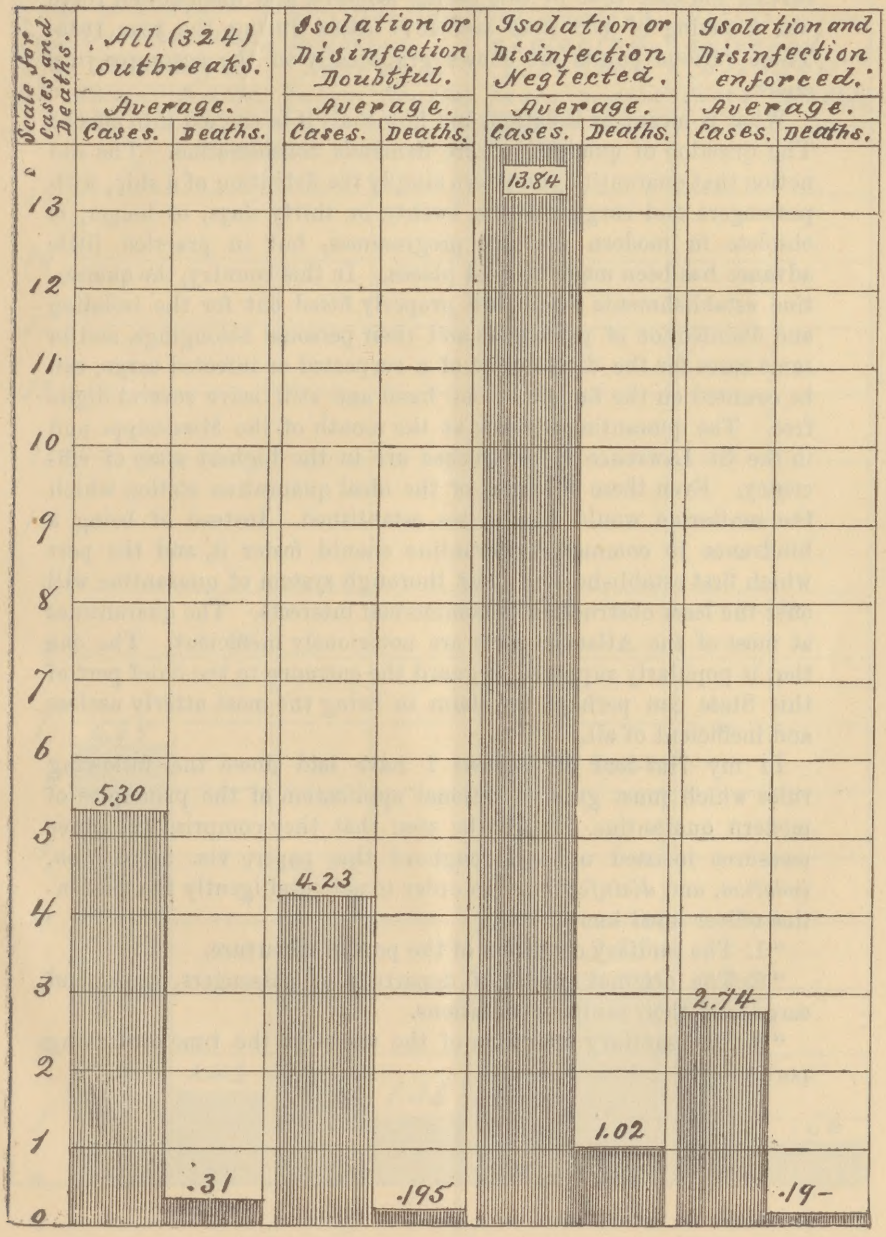
The second factor in the series of measures for the restriction of

infection is isolation of the infected. That isolation and its corollary, disinfection, are effective in the restriction of infectious diseases, has been well shown in the results of the sanitary work of the State Board of Health of Michigan. In the report of that Board for 1886 I find a number of tables and diagrams which are reproduced here by courtesy of Dr. Henry B. Baker, the active and efficient secretary of that body. The diseases especially considered are scarlet fever and diphtheria, the two most dangerous domestic pestilences that constantly confront us in our sanitary campaigns. The table giving the movement of scarlet fever shows that there were in all 324 outbreaks reported during the year, in which there were 1716 cases and 100 deaths, an average of 5.30 cases and .31 deaths for each outbreak. In 221 outbreaks where isolation or disinfection or both were not mentioned or doubtful, there were 934 cases and 43 deaths, an average of 4.23 cases and .195 deaths per outbreak. In 45 outbreaks in which isolation or disinfection or both were neglected there were 623 cases and 46 deaths, an average of 13.84 cases and 1.02 deaths per outbreak. On the other hand, in 58 outbreaks in which isolation and disinfection were both enforced there were 159 cases and 11 deaths, an average of only 2.74 cases and .19 deaths per outbreak. Dr. Baker concludes that if isolation and disinfection had been enforced in all the 324 outbreaks, and the averages had remained the same as in the 58 outbreaks in which isolation and disinfection *were* enforced, the total number of cases would have been only 888, and the total number of deaths 61. The further conclusion seems justified that 828 cases of and 39 deaths from this disease might have been prevented by the enforcement of proper measures of prevention.

The appended diagram shows graphically the influence of the observance and non-observance of restrictive measures.

For diphtheria, similar though more striking results are shown. The number of outbreaks during the year was 461, in which there occurred 3085 cases and 656 deaths, an average of 6.69 cases and 1.42 deaths to each outbreak. In 243 outbreaks where isolation and disinfection were not mentioned or doubtful, the number of cases was 1103 and the deaths 250, an average of 4.54 cases and 1.03 deaths to each outbreak. In 102 outbreaks in which isolation or disinfection or both were neglected, the number of cases was 1650 and the deaths 329, an average for each outbreak of 16.18 cases and 3.23 deaths. In 116 outbreaks, on the other hand, in which isolation and disinfection were carried out, there were 332 cases and 77 deaths,

Scarlet fever in Michigan in 1886: The Average Numbers of Cases and Deaths per outbreak:-1, in all the 324 outbreaks reported; 2, in the 221 outbreaks in which it is doubtful whether or not Disinfection or Isolation were secured; 3, in the 45 outbreaks in which Isolation or Disinfection or both were neglected; and 4, in the 58 outbreaks in which Isolation and Disinfection were both enforced. (Compiled in the office of the Secretary of the State Board of Health from reports made by local health officers.)



or an average of only 2.86 cases and .66 deaths per outbreak. Had the same ratio been maintained and isolation and disinfection been practised in all the outbreaks, there would have been only 1318 cases and 274 deaths instead of 3085 cases and 656 deaths. These figures further indicate that by this partial isolation and disinfection there was a saving of 833 lives and 4374 cases during the year 1886. These various points are shown graphically on the accompanying chart.

What is meant by isolation, and how shall it be carried into effect? The question of quarantine here demands consideration. The old notion that quarantine comprises simply the detention of a ship, with passengers and cargo, for ten, twenty or thirty days, or longer, is obsolete in modern sanitary programmes, but in practice little advance has been made in most places. In this country, the quarantine establishments which are properly fitted out for the isolation and disinfection of passengers and their personal belongings, and in some cases for the disinfection of a suspected or infected cargo, can be counted on the fingers of one hand and still leave several digits free. The quarantine stations at the mouth of the Mississippi and in the St. Lawrence below Quebec are in the highest state of efficiency. Even these fall short of the ideal quarantine station which the sanitarian would like to see established. Instead of being a hindrance to commerce, quarantine should foster it, and the port which first establishes the most thorough system of quarantine will offer the least obstruction to commercial interests. The quarantines at most of the Atlantic ports are notoriously inefficient. The one that is popularly supposed to guard the entrance to the chief port of this State can perhaps lay claim to being the most utterly useless and inefficient of all.

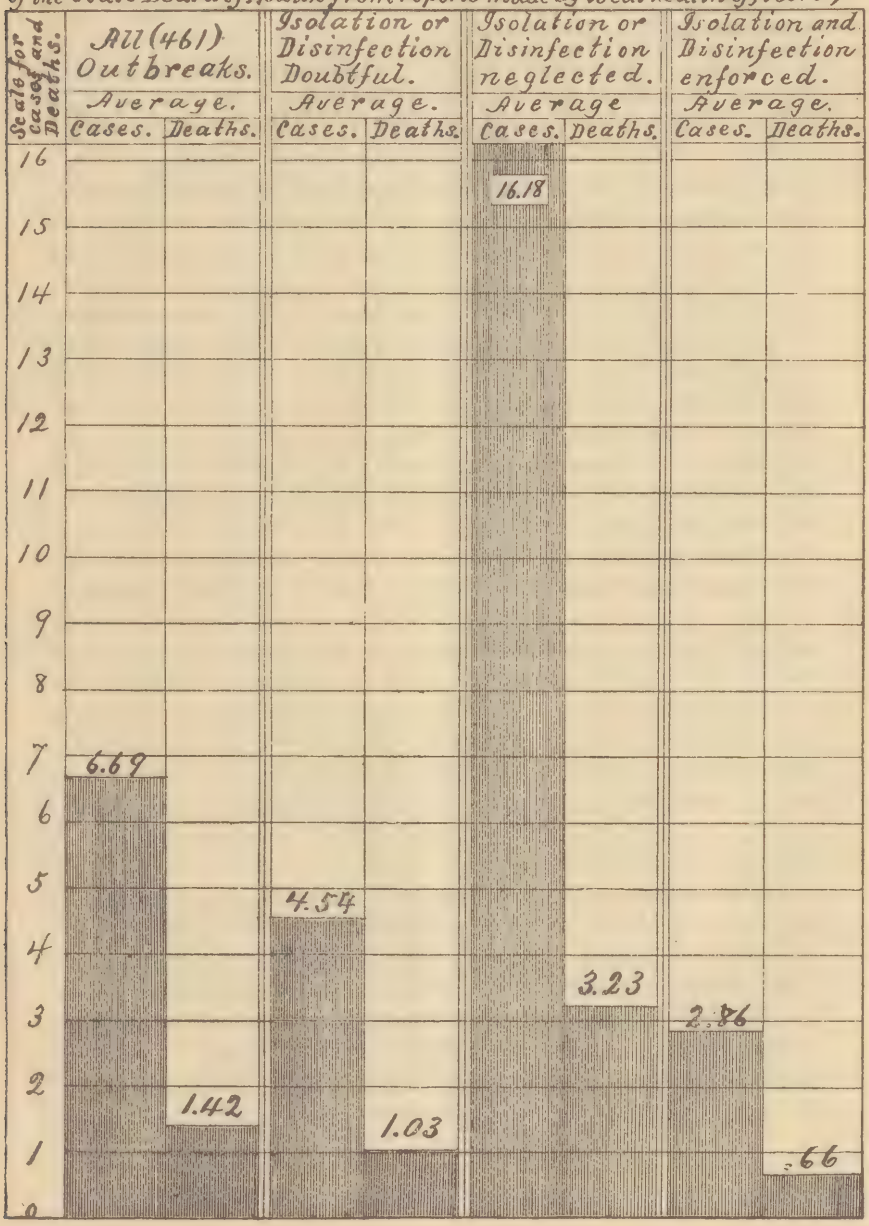
In my *Text-book of Hygiene* I have laid down the following rules which must guide a rational application of the principles of modern quarantine. It will be seen that they comprise the three measures insisted upon throughout this paper, viz. *notification*, *isolation*, and *disinfection*. In order to act intelligently the quarantine officer must know:

"1. The sanitary condition of the port of departure.

"2. The original places of departure of passengers, crew, and cargo, and their sanitary conditions.

"3. The sanitary condition of the vessel at the time of leaving port.

Diphtheria in Michigan in 1886, exhibiting the Average Numbers of Cases and Deaths per outbreak:- (1) in All the 461 outbreaks Reported, (2) in the 243 outbreaks in which it is Doubtful whether or not Disinfection or Isolation were secured, (3) in the 102 outbreaks in which Isolation or Disinfection or both were neglected, and (4) in the 116 outbreaks in which Isolation and Disinfection were both enforced. (Compiled in the office of the Secretary of the State Board of Health from reports made by local health officers.)



"4. The sanitary history of the vessel, crew, and passengers during the voyage.

"5. The sanitary condition of the vessel and contents at the time of arrival and inspection.

"The first, second and third conditions should be fully given in the consular bill of health. In order that this may be trustworthy, a competent medical officer should be attached to every consulate at places of embarkation or shipment. The duty of this medical officer should not be merely to inspect the ship and satisfy himself of her cleanliness before departure, but he should be required to keep himself informed of the sanitary history of all places whence passengers and their effects, or cargo, come, in order that on his advice a clean bill of health may be refused to any vessel which fails to come up to the required conditions. The medical attaché might also be required to inspect the quarters and provisions of crews and passengers, in order to secure compliance with the laws in existence regulating these matters. The passengers and crew should be examined, and if any are found suffering from contagious diseases, they should not be permitted to proceed. No one should be allowed to set foot on a ship who has not been previously vaccinated or protected by an attack of small-pox.

"The sanitary condition of the vessel, crew, and passengers during the voyage is ascertained from the log, which is the official journal of the ship, and from the report of the ship's doctor, if there is such an officer on board. All cases of sickness or deaths which have occurred during the voyage must be reported to the quarantine officer.

"The present condition of the vessel is ascertained by actual inspection at the quarantine station. Through this inspection the health of the crew and passengers, and the condition of the ship as regards cleanliness, character and state of cargo, etc., are determined. With the knowledge obtained from these various sources, the quarantine officer can now act intelligently.

"If the sanitary history of the vessel, passengers, crew, and cargo is good—that is to say, if the vessel is clean, the passengers and crew healthy on embarkation, the cargo and passengers from a non-infected place, the port of departure healthy, and if no contagious disease appeared upon the vessel during the voyage or is present at the time of inspection, the ship may be given 'free pratique,' *i. e.* may be allowed to enter the harbor, discharge her cargo and passengers, without danger of communicating infectious disease.

"If, however, the passengers and cargo come from a locality where a contagious disease is epidemic at the time of departure, or if such an epidemic exists at the port of embarkation and shipment, or has broken out during the voyage, the vessel must be declared infected, no matter whether she has a clean bill of health or not. The passengers and crew with their baggage are disembarked, the latter disinfected, and the former detained on shore until the vessel has been disinfected. All sick are removed to the quarantine hospital until the sickness comes to an end. After the ship and cargo have been thoroughly disinfected, for which purpose it may be necessary to unload the latter, the ship may be allowed to proceed to her wharf and discharge, or the cargo may be directly transhipped at the quarantine station. The passengers and crew must be detained at quarantine until the period of incubation of the disease quarantined against has passed, counting from the time of departure from the infected port, or from the appearance of the last case among them. Hence, if the vessel came from a yellow fever or cholera port, the period of detention need not exceed five days from time of departure or the last exposure.

"Typhus fever may have a period of incubation lasting twelve days, and in small-pox the usual period is two weeks, hence, when these diseases are quarantined against, the detention of passengers must cover the time of these respective periods from the date of the last exposure.

"The proper equipment of a quarantine station comprises residences for the quarantine officers and employes, hospitals for the treatment of the sick, barracks to lodge passengers and isolate those possibly infected, boarding boats, wharves to secure vessels, warehouses in which freight and baggage can be stored, disinfecting chambers, and apparatus by means of which disinfectants can be forced into vessels and disinfecting chambers.

"A quarantine carried out in accordance with these principles might appropriately be called a quarantine of observation and disinfection, with incidental detention."

If, according to modern sanitary principles, quarantine against the importation of disease can be effectually carried out, the same result can be obtained in the struggle against the domestic pestilences, such as diphtheria, scarlet fever, and similar diseases. Domiciliary quarantine, while undoubtedly more difficult to carry out practically, is yet practicable, and absolutely necessary for limiting infection. If the

first case of diphtheria, scarlet fever, typhoid fever, or measles appearing in a community were always promptly notified to the authorities, strictly isolated, and all infectious matter from the case rendered innocuous, the spreading of these diseases would be among the rare occurrences. The patients should be quarantined in an apartment or a house, and no one allowed to come in contact with them except the immediate attendants, who should take proper measures to avoid becoming themselves carriers of contagion. These measures comprise cleanliness, disinfection, and change of clothing when going out from the sick chamber among healthy persons liable to become infected. The success of the antiseptic system in surgery, when rigidly carried out, shows how vitally important is attention to details which to most persons seem immaterial.

One of the most effective aids to proper isolation is the establishment of special isolation hospitals for the treatment of cases of infectious disease. Up to this time, small-pox and typhus fever are the only infectious diseases which have received proper attention from sanitary authorities in this country, so far as this point is concerned. But there can be no question that diphtheria and scarlet fever are at this day far more to be dreaded, when they gain a foothold in a community, than are the others mentioned. Special isolation hospitals for diphtheria and scarlet fever are therefore necessities demanded by the exigencies of modern civilization. In London, special scarlet fever hospitals have of late been constructed, and found especially useful during the extensive scarlet fever epidemic in that city during the past two years. The most noteworthy institution of the kind in existence is, however, the St. Vladimir hospital for children in Moscow. This institution has separate pavilions for measles, scarlet fever, small-pox, diphtheria, syphilis, and mixed or doubtful cases of acute exanthemata. Each pavilion is entirely isolated from the others, and has its own service. It is an excellent model for imitation by other communities.

The only special hospital for diphtheria and scarlet fever cases, to my knowledge, in America is the Willard Parker Hospital in New York, recently established. This is, however, a private charity, I believe, and cannot hope to reach ten per cent of the cases requiring the relief it is intended to furnish. Such institutions must be established and controlled by the public sanitary authorities.

The third of the practical measures to be adopted for the restriction of infectious diseases is *disinfection*. *The Committee on Disin-*

fectants of the American Public Health Association, which body has been at work during the past three years in making laboratory experiments and analyzing the literature upon the subject, has arrived at certain conclusions that will doubtless be accepted as authoritative. This committee has not only investigated the relative value of all the principal disinfectants (including proprietary preparations) in the market, but has in a brief summary given instructions for their proper use. This document represents the best available knowledge upon disinfection and disinfectants at the present time. By disinfection, in the proper and restricted sense of the term, is meant *the destruction of the specific infectious material which causes infectious diseases.* If the view be accepted that all infectious diseases are due to micro-organisms or germs, then a disinfectant would be equivalent to a germicide. In practice and in experimental investigations this view is, in effect, adopted. In testing the action of various disinfecting agents upon infectious material, the biological test is the one universally relied upon by experimenters, and no observations upon disinfection based upon chemical tests merely would be accepted by sanitarians as conclusive. It may therefore be assumed for the practical purposes of this paper that no agent can be accepted as a disinfectant if it is not also a germicide. From this it follows that disinfection to be trustworthy must be thorough. "There can be no partial disinfection of such [infectious] material; either its infecting power is destroyed or it is not."* Obviously also there can be no disinfection in the absence of infectious material. Fecal discharges, clothing, bedding, a ship, or a hospital ward may or may not be infected. In the former case we may speak of disinfecting them; in the latter it would be an inappropriate use of the word.

Antisepsis, which is so frequently confounded with disinfection, should be more accurately defined than is usual by writers. An antiseptic is an agent which delays, prevents or arrests putrefaction. It does not necessarily destroy the life of the organism upon which the putrefaction depends. An antiseptic is not necessarily a disinfectant therefore, although the latter is always an antiseptic, because putrefaction may be looked upon as always the result of an infection by putrefactive germs. The destruction of these germs necessarily arrests the putrefactive process.

Confusion is also liable to arise by considering disinfectants and

* Report of Committee of Disinfectants.

deodorizers as synonymous. One of the most efficient disinfectants at our command (bichloride of mercury) is not a deodorizer at all, except by preventing putrefaction. It will not remove bad odors that are present. On the other hand, some of the most effective deodorants have only a subordinate position in the scale of disinfectants.

The committee referred to divide disinfectants into two classes: those efficient for the destruction of infectious material containing spores, and those which will only destroy infectious material in the absence of spores. Premising that the conclusions of the committee are based upon a long series of experiments and careful study of the literature, I quote the following recommendations:

The most useful agents for the destruction of spore-containing infectious material are:

1. *Fire.* Complete destruction by burning.
2. *Steam under pressure.* 105 degrees C. (221 degrees Fahr.) for 10 minutes.
3. *Boiling in water* for half an hour.
4. *Chlorinated lime.** A 4 per cent solution.
5. *Mercuric chloride.* A solution of 1 : 500.

For the destruction of infectious material which owes its infecting power to the presence of micro-organisms not containing spores, the committee recommends:

1. *Fire.* Complete destruction by burning.
2. *Boiling in water* for ten minutes.
3. *Dry heat.* 110 degrees C. (230 degrees Fahr.) for two hours.
4. *Chlorinated lime.** A 2 per cent solution.
5. *Solution of chlorinated soda.*† A 10 per cent solution.
6. *Mercuric chloride.* A solution of 1 : 2000.
7. *Sulphur dioxide.* Exposure for 12 hours to an atmosphere containing at least 4 volumes per cent of this gas in presence of moisture.‡
8. *Carbolic acid.* A 5 per cent solution.
9. *Sulphate of Copper.* A 5 per cent solution.
10. *Chloride of zinc.* A 10 per cent solution.

The committee would make the following recommendations with reference to the practical application of these agents for disinfecting purposes:

For Excreta.

(*a*). In the sick room:

1. Chlorinated lime in solution, 4 per cent.

In the absence of spores:

2. Carbolic acid in solution, 5 per cent.
3. Sulphate of copper in solution, 5 per cent.

* Should contain at least 25 per cent of available chlorine.

† Should contain at least 3 per cent of available chlorine.

‡ This will require the combustion of between 3 and 4 pounds of sulphur for every 1000 cubic feet of air space.

(*b*). In privy vaults:

1. Mercuric chloride in solution, 1 : 500.*
2. Carbolic acid in solution, 5 per cent.

(*c*). For the disinfection and deodorization of the surface of masses of organic material in privy vaults, etc.

Chlorinated lime in powder.

For Clothing, Bedding, Etc.

(*a*). Soiled underclothing, bed linen, etc.

1. Destruction by fire, if of little value.
2. Boiling for at least half an hour.
3. Immersion in a solution of mercuric chloride of the strength of 1 : 2000 for four hours.
4. Immersion in a 2 per cent solution of carbolic acid for four hours.

(*b*). Outer garments of wool or silk, and similar articles, which would be injured by immersion in boiling water or in a disinfecting solution.

1. Exposure in a suitable apparatus to a current of steam for ten minutes.
2. Exposure to dry heat at a temperature of 110 degrees C. (230 Fahr.) for 2 hours.

(*c*). Mattresses and blankets soiled by the discharges of the sick.

1. Destruction by fire.
2. Exposure to superheated steam (105 degrees C., 221 degrees F.) for ten minutes. (Mattresses to have the cover removed or freely opened.)
3. Immersion in boiling water for half an hour.

Furniture and Articles of Wood, Leather, and Porcelain.

Washing, several times repeated, with solution of carbolic acid, 2 per cent.

For the Person.

The hands and general surface of the body of attendants of the sick, and of convalescents, should be washed with:

1. Solution of chlorinated soda diluted with nine parts of water (1 : 10).
2. Carbolic acid, 2 per cent solution.
3. Mercuric chloride, 1 : 1000.

For the Dead.

Envelope the body in a sheet thoroughly saturated with:

1. Chlorinated lime in solution, 4 per cent.
2. Mercuric chloride in solution, 1 : 500.
3. Carbolic acid in solution, 5 per cent.

For the Sick-room and Hospital Wards.

(*a*). While occupied, wash all surfaces with:

1. Mercuric chloride in solution, 1 : 1000.
2. Carbolic acid in solution, 2 per cent.

(*b*). When vacated:

* The addition of an equal quantity of potassium permanganate as a deodorant, and to give color to the solution, is to be recommended.

Fumigate with sulphur dioxide for 12 hours, burning at least 3 pounds of sulphur for every 1000 cubic feet of air space in the room ; then wash all surfaces with one of the above mentioned disinfecting solutions, and afterward with soap and hot water ; finally throw open doors and windows and ventilate freely.

For Merchandise and the Mails.

The disinfection of merchandise and of the mails will only be required under exceptional circumstances ; free aeration will usually be sufficient. If disinfection seems necessary, fumigation with sulphur dioxide will be the only practicable method of accomplishing it without injury.

Rags.

(*a*). Rags which have been used for wiping away infectious discharges should at once be burned.

(*b*). Rags collected for the paper-makers during the prevalence of an epidemic should be disinfected before they are compressed in bales by :

1. Exposure to superheated steam (105 degrees C., 221 degrees Fahr.) for 10 minutes.
2. Immersion in boiling water for half an hour,

Ships.

(*a*). Infected ships at sea should be washed in every accessible place, and especially the localities occupied by the sick, with :

1. Solution of mercuric chloride, 1 : 1000.
2. Solution of carbolic acid, 2 per cent.

The bilge should be disinfected by the liberal use of a strong solution of mercuric chloride.

(*b*). Upon arrival at a quarantine station, an infected ship should at once be fumigated with sulphurous acid gas, using 3 pounds of sulphur for every 1000 cubic feet of air space ; the cargo should then be discharged on lighters ; a liberal supply of the concentrated solution of mercuric chloride (4 ounces to the gallon) should be thrown into the bilge, and at the end of 24 hours the bilge water should be pumped out and replaced with pure sea water ; this should be repeated. A second fumigation after the removal of the cargo is recommended. All accessible surfaces should be washed with one of the disinfecting solutions heretofore recommended, and subsequently with soap and hot water.

For Railway Cars.

The directions given for the disinfection of dwellings, hospital wards and ships apply as well to infected railway cars. The treatment of excreta with a disinfectant before they are scattered along the tracks seems desirable at all times in view of the fact that they may contain infectious germs. During the prevalence of an epidemic of cholera this is imperative. For this purpose the standard solution of chlorinated lime is recommended.

Among the proprietary disinfectants tested by the committee in 1885 was one which was sold under the name of *Little's Soluble*

Phenyle. It is a thin tarry liquid, with an odor somewhat resembling carbolic acid. It is freely miscible with water, and acts as an efficient disinfectant and deodorizer in a two per cent solution. A preparation sold under the name of *Creolin* has lately been tested in Koch's laboratory and highly recommended as a disinfectant both for sanitary and surgical purposes. This appears to be phenyle under another name. The American committee declined to recommend any proprietary preparation, but where the poisonous properties of mercuric chloride offer an insuperable objection, phenyle will answer an excellent purpose, as it is both cheaper and more efficient than carbolic acid.

Disinfection should be carried out by or under the direction of the municipal health authorities, but the customary methods which are in use should cease. The muslin portière, saturated with solution of carbolic acid, hung in the doorway of the sick-room to restrict the infection, is a delusion; the saucer of chlorinated lime in the sick-room is a useless annoyance, while the perfunctory fumigation with sulphur after the infected apartment is vacated only acts as a snare to the unwary. It is better not to attempt to disinfect at all than to practice such make-believe disinfection.

A necessity of the times are public disinfecting stations, where the personal and household effects of the poor may be disinfected after exposure to infectious diseases. The city of Berlin has led the way in the establishment of such stations, and this advance has been followed by a number of other German and of French cities. The report of the Berlin station gives evidence of the great benefits derived from this innovation. Public disinfection in some diseases is practiced in many communities in this country and in England, but the methods in use in many of them are not trustworthy. Exposure to steam would appear to be the best method for disinfecting articles of bedding and wearing apparel, especially such as cannot be immersed in boiling water or a disinfecting solution.

It has been my endeavor in this report to indicate the practical measures by which the ravages of infectious diseases can be restricted, and at the same time to bring to the attention of physicians, sanitary officials, and the public, facts which go to show that the claims made in behalf of such measures are neither impracticable nor illusory.

The objections usually urged against sanitary improvements are of two kinds: one, that such improvements have not accomplished what was claimed for them, and another, that they are too expensive. To

the first, the facts stated in this paper will perhaps be a sufficient answer. As regards the second, it may be said that nothing is so valuable to a community as the health of its members, and any reasonable expenditure of money would be well invested if the sickness and death rate were thereby lowered. A little judicious investment in brains may sometimes be profitable in the sanitary administration of a community as well as in the financial management of its resources.

Discussion.

Dr. John S. Conrad, in referring to Dr. Rohé's remarks, said that when he was quarantine officer he had noticed the absolute folly of quarantine as then in use. He advocated that no State should control quarantine. It should be in the hands of the Government and as a part of the U. S. Marine Service. Different States have different laws, and one may have a stricter quarantine than another, and thus trade is diverted and the commerce of the port affected. As conducted at this port, segregation is imperfect. Persons in quarantine for one disease are apt to catch another. It is a sham and a danger. He wished to know what evidence Dr. Rohé had to show that the disinfectants mentioned would kill all germs. Chloride of lime is not without harm to fabric.

Dr. John Morris said it was just as easy to establish an internal quarantine as an outside one. During the past year there had been three cases of small-pox in the city, but the law was obeyed and the health officers were efficient, and hence the disease did not spread. People were completely isolated at the quarantine hospital here. In regard to compensation, he thought it was the religious duty of every physician to report promptly all contagious diseases and thus do a noble act without pay.

Dr. William B. Canfield, in referring to the inefficiency of the quarantine here, said that he left Bremen early in June, 1886, on a crowded steamer for Baltimore. After several days a case of small-pox developed among the steerage, and it was even reported that there were two cases there. All on board were promptly vaccinated and every possible precaution was taken. The steamer was delayed at quarantine but about 15 minutes and landed her passengers promptly. A few weeks later a case of small-pox, causing others, appeared on a western farm and it was traced to the steamer of this date.

Dr. George H. Rohé, in concluding, remarked that he could bring evidence, with more time, that the chemicals named by him in these solutions would destroy all known germs. He thought it was a nuisance and often an expense to a household to report a case of infectious disease, and hence this was often omitted. This should all come on the government or local authorities.